eobody²
www.eowave.com

USB sensor interface

User's Manual

Safety instructions

Before using your Eobody2, make sure you have read the following instructions carefully.

Do not open or modify the unit or its main adapter when the unit is externally powered.

During ligthning, unplug the unit, make sure the main adapter (if one) is not plugged.

Before cleaning your Eobody2, make sure the main adapter and/or any external elements are disconnected from the unit.

Do not try to repair the interface or the components inside of it. Please contact eowave for technical support at sales@eowave.com

Do not use your Eobody2 nor store it in dusty areas, damp areas, extreme temperatures, exposed to direct sunlight, areas prone to strong vibrations.

If you need to use a main adapter, make sure of the adapter output polarity, voltage and current are correct.

Do not insert any objects nor pour any liquid into the unit.

Protect the unit against violent shocks.

Before using Eobody2 in a foreign country, make sure that your main adapter is compatible with the main supply.

Never touch your Eobody2 nor its adapter with wet hands when it is plugged in.

Never place heavy objects on your Eobody2.

If the unit is not to be used for a long period, disconnect the adapter from the main.

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Congratulations

Congratulations!
You now own a new Eobody2 usb 8 SensorBox, a versatile and plug and play usb-to-sensor interface to use sensor direclty with your sequencer softwares or with softwares like Cycling'74 Max/MSP/Jitter.
Eobody2 usb 8 SensorBox is unique because it offers an internal powerful processing to shape the outcoming sensor signal and get the best results in a intuitive and easy way. No MIDI interface needed, no skills in computer programming required.
Eobody2 usb 8 SensorBox is the first module of a very flexible & versatile sensor system whom core is your computer. More modules will be developped in a very near future.

Unpacking

Your Eobody2 package should include the following items. Make sure everything is in the box.

- usb 8 inputs Eobody2
- a registration card
- 1 usb cable

Who’s Who

« eowave was founded in 2002. Since 1998, we have designed our first products under the name of More Electronic Sounds. We have started with the development of software and on hardware design of analogue machines and midi tools. There is not such a big gap between developing software and hardware: both are a subjective representation of the definition of the sound process. I really enjoyed developing iSynth. With the Essential Instruments from Cycling’74’s Pluggo 3, each module is dedicated to a special synthesis: granular, additive synthesis, FM, an analogue modeling synth or a wavetable synth… I have tried to extract the essential of synthesis, starting all over again with fundamental questions: «what’s an FM synthesis & how should it be concretized?» Now, some analogue effects I have designed - the little analogue effects called the «bugs» for example - can be viewed as some kinds of hardware Essential Instruments. Several little boxes, each representing an effect, a multimodal filter, a ring modulator, a phaser or a sequencer. Several little boxes any musician can use to add an analogue feeling to his music… Several easy-to-use little boxes which can be used alone or assembled to create new sounds. But aside the search for new tools, and new ways of expression is a real quest among unknown dimensions. The world of synthesis is immense, while the world of expression has no limits. At this frontier comes the Eobody2 an ideal intermediate between the external audio and video environment and artist, the essentiel bridge linking the world of analogue sensors to the world of digital process.”

Marc Sirguy, eowave CEO

Sensors & new ways of expression

From the Idea…

Men have always dreamt of new ways of communication. Through ages, men have thought of their body as a tool of communication. And indeed, when communicating, this is not only your voice, nor the only expression in your face that transmits a message, but your entire way of being. This is your entire body which projects you inside the individual world of one another. In all cultures, men have developped new ways of communication through dance, music, art. And still in a matter of a better communication, men have always worked to improve the interaction between men and machines, thus since the very beginning of mechanics and later, electronics. More and more, the body has become the cornerstone of interactive systems of communication. New technologies widen the range of controls. And controls have entered everyday's life without us noticing. Remote controls are everywhere: we control TV, we control VCRs, DVDs, stereos, ovens, climates, windows, garage doors… Control surfaces are everywhere. Faced to art, control appears to be the new way of expression of this early millenium. Many artists are looking for new ways of expression, of conceptualizing ideas… In this perspective, sensors open new dimensions of expression. Eobody2 is the key link between the world of analogue sensors and digital systems.

…To the Realization

An early version of Eobody2 has been first presented at NIME 2007 (New Interfaces for Musical Expression) hold at New-York University in June 2007. The idea was to keep a plug and play modular system to use sensors as well as relays, CVs... The usb 8 SensorBox is one of the first modules of this new Eobody2 interactive system. One SensorBox enables to plug 8 sensors and use them directly with your sequencer software, but you can also plug more if you need more inputs for other sensors. The goal was to come to a plug & play solution and versatile solution (and at a reasonnable price) for all those who don't want to go into computer programming or wire soldering, but whose job is to create music, live, video apps, sensor-based instruments or installations...

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I. Register and Install

Register

You may register on www.eowave.com/register by entering your Eobody2 serial number. This number is located on a sticker on the back of the unit. Registering will give you a member access to download page to download the editor, user manual, patches, news, upgrades...

On www.eowave.com/register, fill in the online registration card and enter your serial number.

Downloads

Download and install the editor

On www.eowave.com/download page, click on the editor you want to download (usb sensorbox editor). Eobody2 usb sensorbox Editor is Mac, MacIntel and PC compatible.

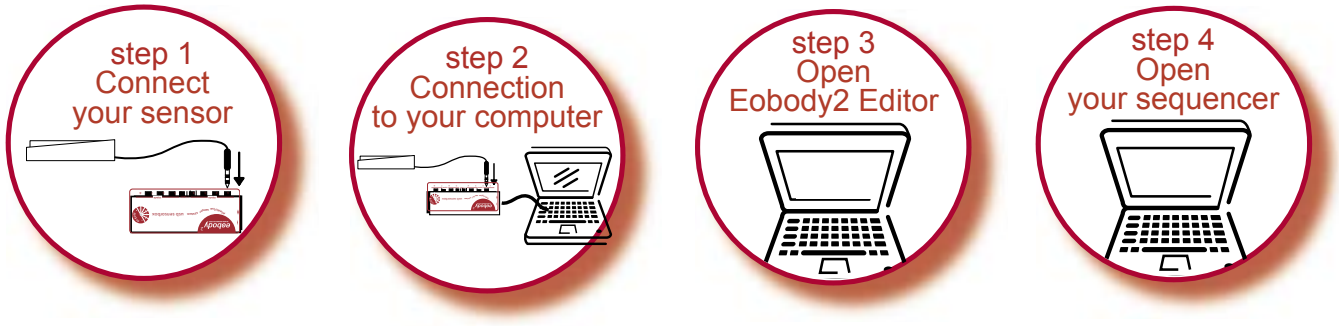
For Maxers
If you are a Maxer and want to use Eobody2 with Max/MSP/Jitter, a Eobody2 usb sensorbox Editor collective file is available to avoid having 2 Max apps running on the same computer.
Different eowave-made Max patches are also available. (See downloads).

When the installation is over, a window pops up and tells you that the installation was successful.

Download the manual

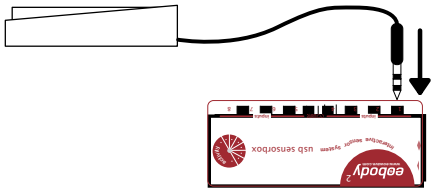
On www.eowave.com/download page, click on the Eobody2 usb sensorbox manual pdf file.

II. Connections



II.1 Step 1: Connect a sensor to Eobody2

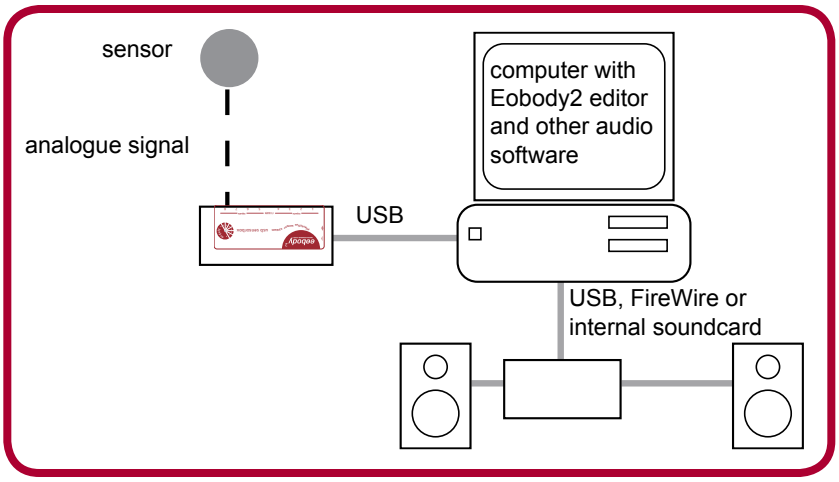
Eowave sensors compatible with the usb eobody2 interface have TRS 1/4'' jack connectors. Note that Eowave sensors that were compatible with Eobody1 are also compatible. Other kind of sensors can also be used (See "Make my own sensor" section).



To connect a sensor to Eobody2, just plug the TRS 1/4'' jack in one of the female jack in from Eobody2 (inputs 1 to 8). Sensors like accelerometers need 2 inputs. (See Sensors available for sensor technical specs)

Note that this is highly recommanded to connect the sensors to Eobody2 before starting your sequencer software. Unplugging sensors while using your sequencer software may cause breaks during the usb data transmission which could lead you to restart your software.

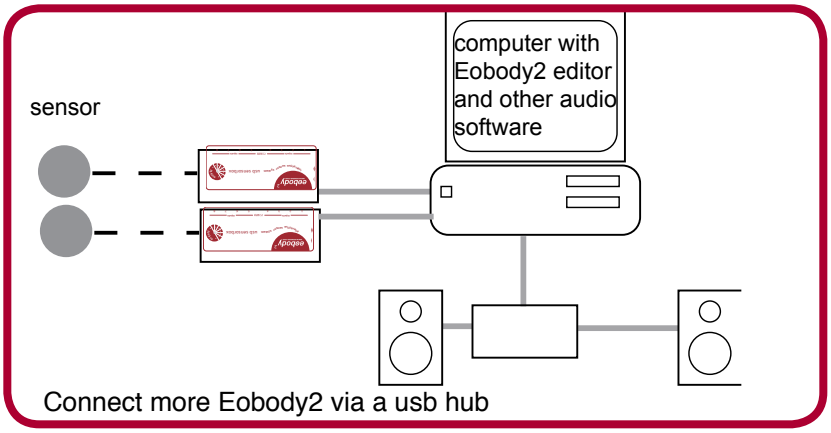
II. 2 Step 2: Connection to your computer

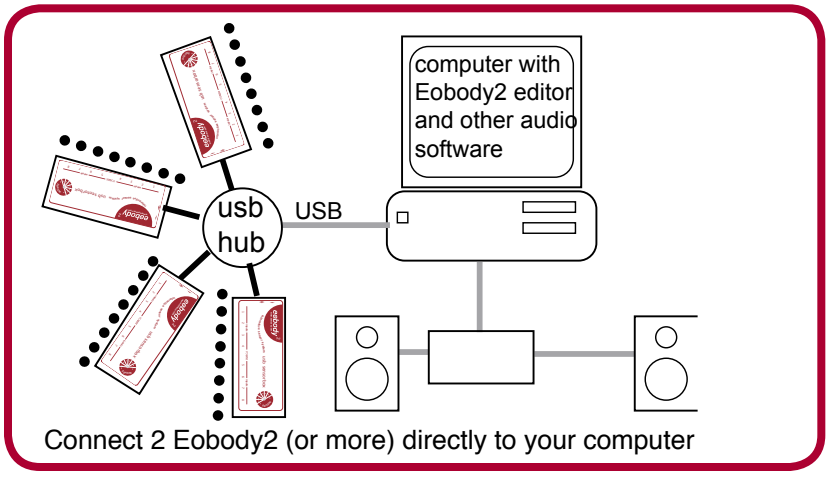


To connect your Eobody2 to your computer, connect the USB cable to your computer USB in (or to any USB hub connected to your computer). You do not need any MIDI interface.

When connected to your computer, Eobody2 will appear like a new audio peripherical for PC, like Eobody2 MIDI interface with Macs.

II.2. Connect 2 or more Eobody2 to your computer



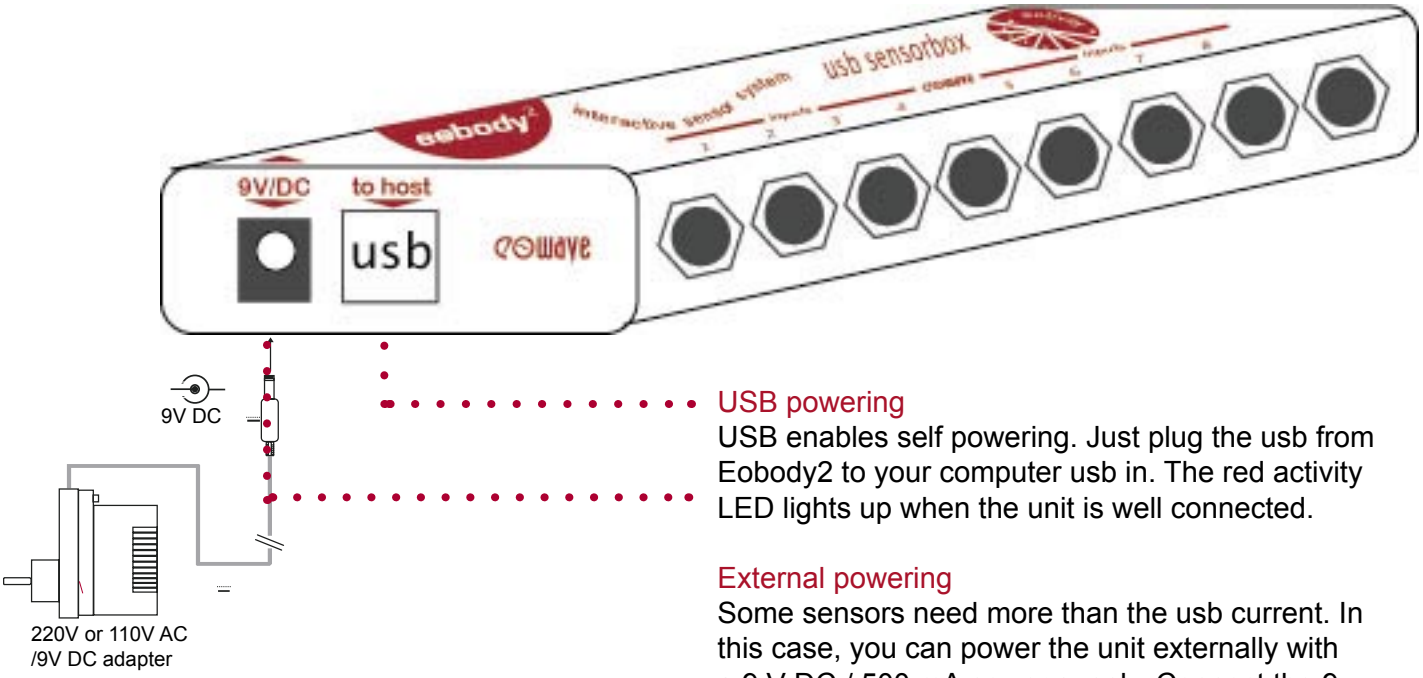


Two or more Eobody2 can be connected directly to the USB inputs of your computer, but they can also be connected via a USB hub.

When several Eobody2 are connected, they will appear like different audio peripherical with PCs, different Eobody2 MIDI interface with Macs.

When the units have been named, their given name will appear.
(See Global Parameters Section).

II.3. How is the unit powered?



USB powering

USB enables self powering. Just plug the usb from Eobody2 to your computer usb in. The red activity LED lights up when the unit is well connected.

External powering

Some sensors need more than the usb current. In this case, you can power the unit externally with a 9 V DC / 500 mA power supply. Connect the 9 V DC / 500 mA power supply into the power plug connector of Eobody2. The red activity LED lights up when the unit is well connected. An internal fuse is activated when not plugged right to avoid major internal damages.

How do I know that I need an external powering?

All 5V sensors need external powering. Eowave 5V sensors are distance sensors.

activity LED

The activity LED will also indicates that an external powering is required if it does not lights when right plugged.
If the activity LED stops lighting when you plug a new sensor, it may be a indication for a lack of powering. Try to unplug some sensor to reduce the powering needs. If the activity LED lights up again when less sensors are plugged, connect an external powering before plugging more sensors. Keep in mind that the power delivered via USB is not always stable and, depending on your computer, can be too weak to power sensors which would normally require a 0,5V.

III. Eobody2 editor

III.1. Global parameters window

Open the editor

One of the first thing you did when you got your Eobody was to download and install the editor. Refer to “Register and Install section if you have not).
Double click on the editor icon to open it. The Global parameter window will appear. Inside the Global Parameters Editor Page, the first three sections are defining the connection between Eobody2 interface and your computer (select MIDI port; name your eobody; save/load). The fourth section is dedicated to Eobody2 internal memory configuration.

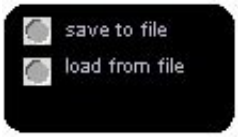
III.2. Eobody2 and your computer

Select Eobody2 MIDI port

Eobody2 uses the MIDI portocol to transfer data, that means it is compatible with almost every MIDI software. As it is not using the standart data tranfer rate of 32500 Hz but a much more faster rate, it might cause some problems with some softwares.
If you use a PC, Eobody2 will appear as Periphérique audio per default. On a Mac, it will appear as “eobody2”. The LEDs in & out will light up when receiving/sending messages.

your eobody name

displays the name of your Eobody2 unit. This function is very useful when you use more than one Eobody2. This given name will appear as the name of the unit. To rename your Eobody2 unit, click on ‘change name’ in the fourth section below.



save to file

save configuration inside your computer hard drive.

load to file

load configuration from your computer hard drive.

III.3. Eobody2 internal memory configuration

check current parameters
check the internal memory of Eobody2 unit.

save current parameters
save current parameters inside the Eobody2 internal memory. Eobody2 has an internal memory to store parameters settings. You may store an entire installation or performance configuration inside one or more Eobody2 and keep it (or them) as back-up units for a future use.

init all parameters
initialize to factory settings.

revert to save
go back to the configuration saved last.

all off
disactivate all parameters.

delay
As USB is very fast, some older computer can have problems to receive the high data flow. Increasing the delay will reduce the data flow. It will make Eobody2 analyse the analogue input not every scan cycle.

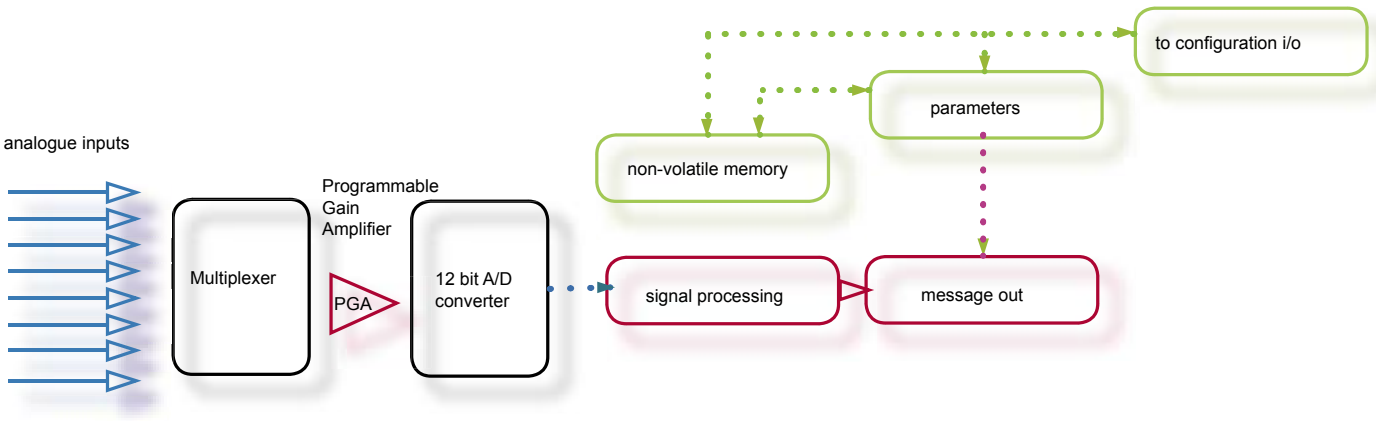
change name
rename your Eobody2 unit. The new name will be displayed in the section ‘your Eobody name’.

check name
check the name of the Eobody2 unit you are editing when you are editing more than one.

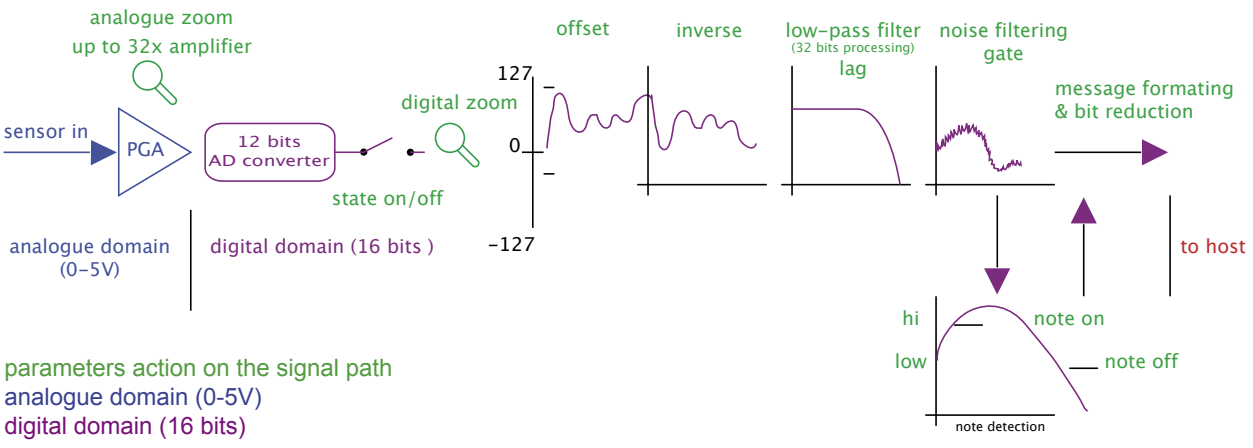
print incoming messages
print to screen incomig MIDI messages.

Internal process & editor parameters

Eobody2 offers a complex internal pre-processing of the data you may set in the editor.



Eobody2 internal processing



Signal path and Eobody2 editor fine parameters internal processing

III.5. Parameters window

Open the Parameters window

To open the Parameters window, click on the arrow preceeding PARAMETERS.
The Parameters window enables to adjust internal processing parameters for each input (1 to 8).
Refer to the description of each parameter for use. To increase or decrease parameter values, click on the case you want to edit and slightly move up or down your mouse.
Note that all setting parameters changes are made in real time. To save a configuration, click on «save current parameters».

What are these internal processing parameters?

Eobody2 usb sensorbox is not just an analogue-to-digital converter, it has a unique internal processing especially designed to analyse, process and configure the signal before it is sent to the host. This internal processing offers several advantages.
> Pre-configured parameters processings have been designed considering most common sensor use and are perfectly adapted to sensor use for musical or video applications.
> You can use Eobody2 directly with your software sequencer without programming needs.
> Internal processing does not use your computer cpu, so you can keep more cpu resources for your apps.
> Internal configuration can be saved inside Eobody2 internal memory for future use.
> Parameters filter the signal to optimize data to be sent to the computer and get a better response from sensors. With these, you will be able to choose parts of the signal to be processed, define the signal resolution, add a noise gate, a lag low-pass filter, inverse the signal, choose the type of message to be sent...

status

on/off

The status field indicates whether the signal on an analogue input should be converted into a digital message or not. This field may be set to ON or OFF. If the field is set to OFF, the input is said to be inactive and no message relating to that input will be generated, even if a signal does physically enter the device. If the field is switched back to ON, the input is active and its associated message will be sent each time the signal connected to that input varies in level.

Note:The smaller the number of active inputs is, the less data will be transmitted avoiding processor computation.

analogue zoom

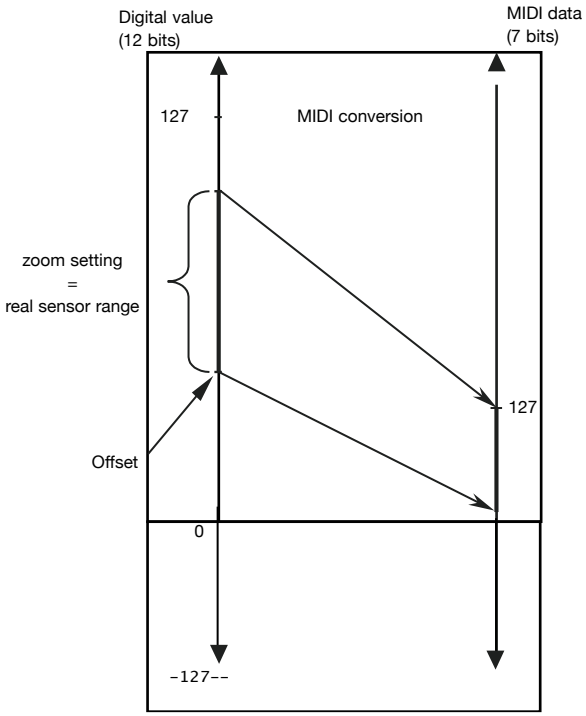
“analogue zoom” controls the internal PGA (Programmable Gain Amplifier).

1-8 gives a factor of 1 - 32 amplification. The use of analogue zooming will keep the full bit depth of 4095 values.

digital zoom and offset

digital zoom: max/mid/low/off on 7

offset: -127 to +127



Want to stay in the 7-bit MIDI world...

Those two parameters (digital zoom and offset) specify how the real range of an analogue input can be mapped on a 7-bit MIDI value. As a matter of fact, a sensor does not necessarily have a range equal to the reference voltage of the Analogue to Digital Converter. A custom scaled zoom has been implemented on the digital value to take advantage of the 12-bit resolution of the A/D converter. First, the voltage reference has to be set to the largest range among the sensors connected to the unit. Then, the user can select the sensor’s range within the 12 bits dynamic by specifying a window size and an offset. The selected range can then be converted into 7 bits MIDI data without greatly increasing the quantification step, as shown in the illustration.

The digital zoom & offset parameters may be very useful to modulate a filter on a certain part of the amplitude.

inverse

127 becomes 0 and 0 becomes 127. This way you may inverse the curse of a sensor. With an expression pedal, for example, you'll be able to inverse its curse.

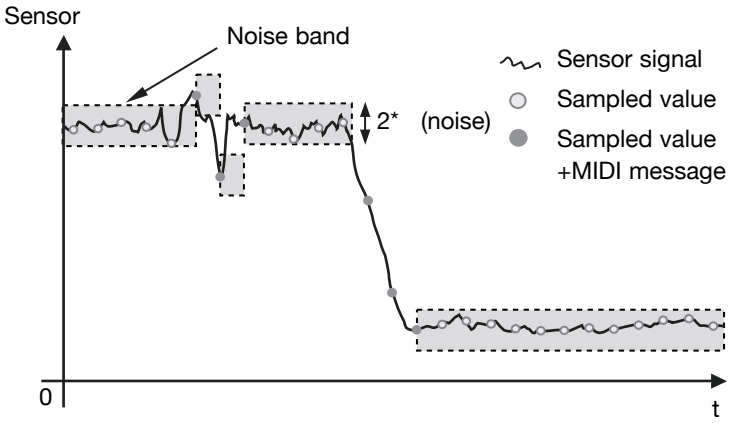
filter

0-64

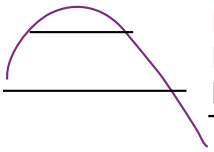
32 bits low-pass filter that smoothes the signal - for unstable sensors.

gate

noise gate:12 values [0-11]



A noise gate threshold reduces the bit depht of the signal. If the analogue signal moves inside the range of the noise gate, no message will be sent. This field enables the user to set the width of the range. A large range will be very effective against strong noise but will make the values less sensitive to a relevant change of the analogue signal. A threshold of 5 corresponds to 127 different possible values (ie: the analogue has to change at least of 32 (from 4095 above or under its current position to be detected as changing). A threshold of 11 corresponds to 2 bits , usefull for switches or all on/off sensors.

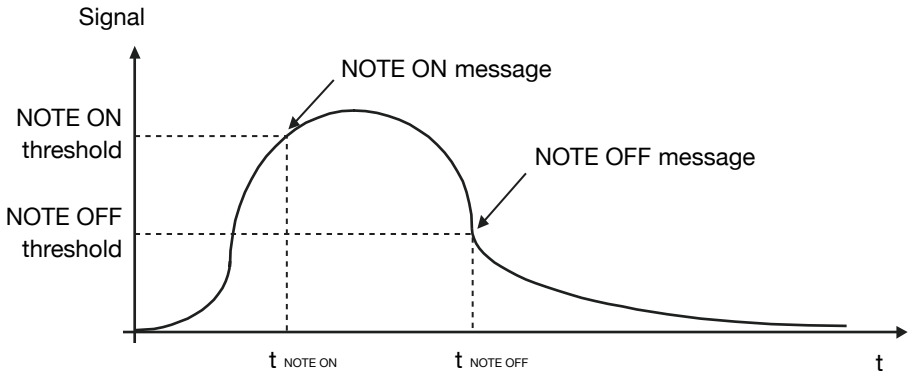


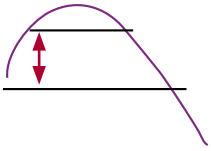
Note on message

N-ON trigger

hi-low

The analogue signal must correspond to an envelope changing with time and which has a maximum value. 3 parameters need to be specified: note sent, higher threshold, lower threshold. Eobody2 analyses this envelope: once the envelope has reached the higher threshold, a MIDI note on message (NOTE ON) is generated. The velocity associated with the note is fixed to 127. The note number contained within the message is adjustable by the user. As long as the envelope stays above a threshold point, named NOTE OFF threshold, the note is maintained (no new MIDI message is sent). When the level falls beneath the NOTE OFF threshold point, a MIDI NOTE OFF message is sent to turn the note off. To sustain the note for a long period of time, the NOTE OFF threshold point must be set on a small value. Conversely, to make the note stop shortly after the peak has been detected, the NOTE OFF value must be higher. This type of message is useful in using sensors to generate MIDI notes.





low

0 - 127

This field enables the user to configure the note on activation level for trigger messages or for the MSB controller number with a lower threshold.

hi

0 - 127

This field enables the user to configure the note on activation level for trigger messages or for the MSB controller number with a higher threshold.

Formating messages to host

type

This is one of the most important configuration parameters, since it determines which type of MIDI message the device is going to send in response to variations in a particular analogue input. Eobody2 is capable of generating 5 different messages:

• CC: Control number change (Control change) 7 bits
CC: Control number change (Control change) 12 bits (the 5 LSB bits are mapped on CC number + 64
• Note: Note on Trigger
• PC: Program change
• PB: Pitch bend (Variation in pitch) real 12 bits
• PB: Pitch bend (Variation in pitch) mapped 14 bits
• ATm: Monophonic aftertouch (Channel pressure)

CC Control Change

This is the type of message which will likely be most often used for controlling sound parameters. The value of the analogue signal acts directly upon the value of a MIDI controller, using a MIDI controller Value Change message (control change). The number of the controller can be set by the user. If 12 bits resolution is selected, this message will actually send two Control Change messages. The controller specified in the val field will send the 7 least significant bits whilst the controller specified in the “low” field will send the 3 most significant bits, on the same MIDI channel.

Program Change message PC

The analogue signal must correspond to an envelope changing with time and which has a maximum value. You will have to specify 3 parameters, Program Change sent, higher treshhold, lower treshold. Eobody2 analyses this envelope: once the envelope has reached the higher threshold, a MIDI Program Change message is generated. The Program Change contained within the message is adjustable by the user. As long as the envelope stays above a threshold, named lower threshold, the Program Change is maintained (no new MIDI message is sent). When the level falls beneath the lower threshold, the Eobody2 is ready to receive a new Program Change message.

Pitch Bend PB

This message allows an analogue signal to generate a MIDI message of the pitch change type (pitch bend). Pitch is usually coded over 14 bits. If the 7 bits resolution is chosen, they will be mapped on the 7 most significant bits of pitch information controlled by the analogue signal. However, since Eobody2 does 12 bits conversions internally, the whole 12 bits can be mapped to take better advantage of the pitch bend message. This message is used to simulate the pitch changing wheels available on most MIDI keyboards.

Monophonic Aftertouch ATm

This message allows an analogue signal to generate a channel pressure type MIDI message (channel aftertouch). This pressure message affects a whole MIDI channel, regardless of what note is played. The channel number to which the pressure information is applied is selected by the user.

message Channel: [1-8]

This field enables the user to select a MIDI channel to which the MIDI message will apply (1 to 8).

value val: 0 - 127

This field enables the user to set the fixed parameter of a MIDI message associated with an analogue input. This parameter value may correspond to a MIDI note number, a MIDI controller number or a MIDI program number, depending on the type of MIDI message which is chosen.

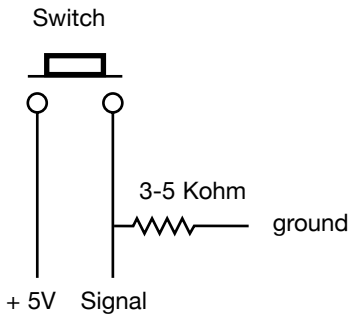
Configuration map for analogue inputs

Type of message	Res.	Value	Hi	Low
CC - Control Change	7 bits	CC value		
CC - Control Change	12 bits	CC value		
Note - Note on trigger	7 bits	note number	higher threshold	lower threshold
PC - Program Change	7 bits	PG value	higher threshold	lower threshold
PB - Pitch Bend	12 bits			
PB - Pitch Bend	14 bits			
ATm - monophonic aftertouch	7 bits			

IV. Making my own sensors

eo•body supports many kind of sensors. Most common sensors are switches and potentiometers, but there are many other kinds of sensors.

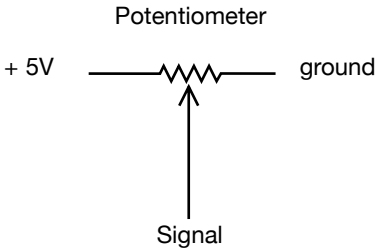
Making my own sensor switch



(to avoid antenna effect when the switch is off)

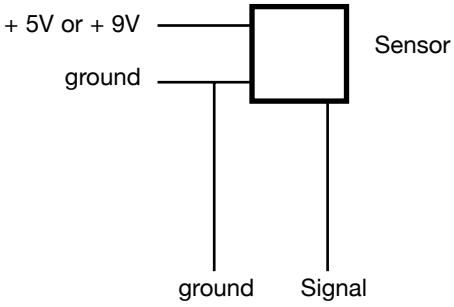
Sensors need a minimum of two cables: ground and signal. When 5 V is connected to the signal - when using switches for example - it may create an antenna effect generating undesirabled distorsion. This is the reason why the signal must be connected to the ground.

Making my own sensor potentiometer



To use a standard potentiometer with eo•body, connect both outputs of the potentiometer resistor to the ground and 5 V. Connect the variable output of the potentiometer to the signal input.

Making my own sensor with other kinds of sensors

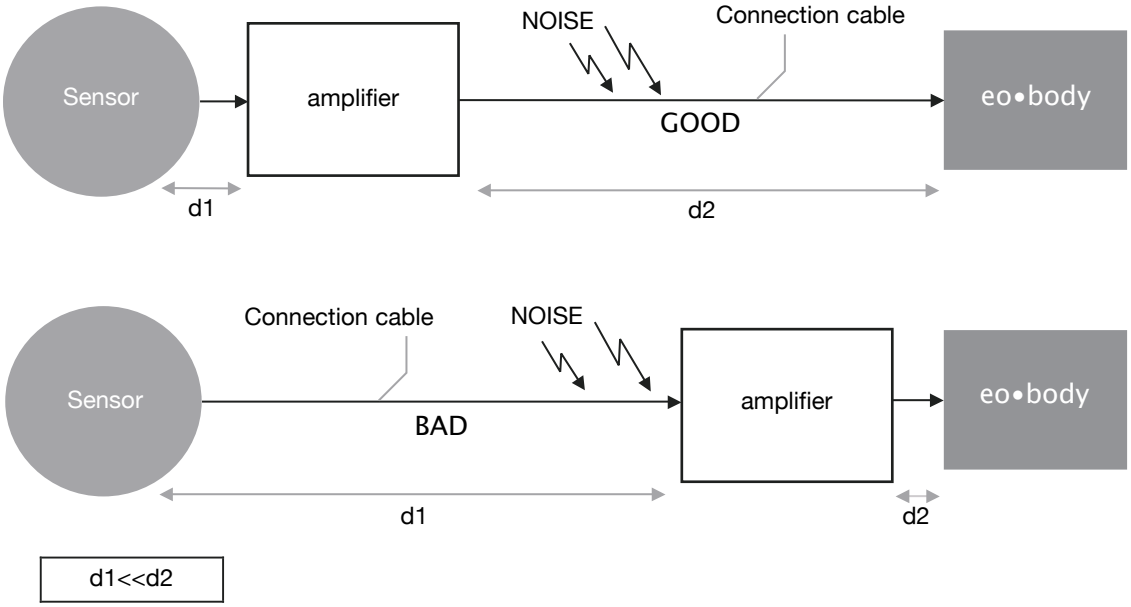


Coming from Eobody2 or external power supply (any other voltage has to come from an external power supply).

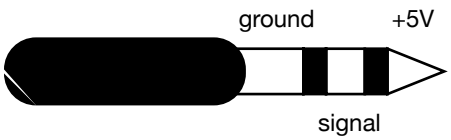
Some sensors like distance sensors need an extra power supply. Eobody2 delivers +5V and +9V to power these sensors up to 250 mA. When the total consumption from all the sensors plugged to Eobody2 is higher than 250 mA, an additional external power supply is necessary.

Amplification

Some sensors have a weak signal out and need amplifying. To avoid undesirable noises, the amplifier should be placed as close as possible from the sensor.



TRS 1/4" jack 6,35 mm connectors



Tip:	+5V
Ring:	signal
Sleeve:	ground

V. List of MIDI Controllers

N°	Function	Value		N°	Function	Value	
0	Bank Select	0-127	MSB	65	Portamento on/off	≤63=off ≥64=on	
1	Modulation wheel	0-127	MSB	66	Sustenuto on/off	≤63=off ≥64=on	
2	Breath control	0-127	MSB	67	Soft pedal on/off	≤63=off ≥64=on	
3	Undefined	0-127	MSB	68	Legato footswitch	≤63=off ≥64=on	
4	Foot controller	0-127	MSB	69	Hold 2	≤63=off ≥64=on	
5	Portamento time	0-127	MSB	70	Sound Controller 1	0-127	LSB
6	Data Entry	0-127	MSB		(Sound Variation)		
7	Channel Volume	0-127	MSB	71	Sound Controller 2	0-127	LSB
	(formerly Main Volume)				(Timbre)		
8	Balance	0-127	MSB	72	Sound Controller 3	0-127	LSB
9	Undefined	0-127	MSB		(Release Time)		
10	Pan	0-127	MSB	73	Sound Controller 4	0-127	LSB
11	Expression Controller	0-127	MSB		(Attack Time)		
12	Effect control	0-127	MSB	74	Sound Controller 5	0-127	LSB
13	Effect control	0-127	MSB		(Brightness)		
14	Undefined	0-127	MSB	75	Sound Controller 6	0-127	LSB
15	Undefined	0-127	MSB	76	Sound Controller 7	0-127	LSB
16-19	General Purpose	0-127	MSB	77	Sound Controller 8	0-127	LSB
	Controler			78	Sound Controller 9	0-127	LSB
20-31	Undefined	0-127	MSB	79	Sound Controller 10	0-127	LSB
32	Bank Select	0-127	LSB	80-83	General Purpose	0-127	LSB
33	Modulation	0-127	LSB		Controller (5-8)		
34	Breath control	0-127	LSB	84	Portamento Control	0-127	Source
35	Undefined	0-127	LSB				Note
36	Foot controller	0-127	LSB	85-90	Undefined	0-127	LSB
37	Portamento time	0-127	LSB	91	Effect 1 Depth	0-127	LSB
38	Data entry	0-127	LSB	92	Effect 2 Depth	0-127	LSB
39	Channel Volume	0-127	LSB	93	Effect 3 Depth	0-127	LSB
	(formerly Main Volume)			94	Effect 4 Depth	0-127	LSB
40	Balance	0-127	LSB	95	Effect 5 Depth	0-127	LSB
41	Undefined	0-127	LSB	96	Data entry +1	N/A	
42	Pan	0-127	LSB	97	Data entry -1	N/A	
43	Expression Controller	0-127	LSB	98	Non registered	0-127	LSB
44	Effect control 1	0-127	LSB		Parameter Number LSB		
45	Effect control 2	0-127	LSB	99	Non registered	0-127	LSB
46	Undefined	0-127	LSB		Parameter Number MSB		
47	Undefined	0-127	LSB	100	Registered	0-127	LSB
48-51	General Purpose	0-127	LSB		Parameter Number LSB		
	Controller (1-4)			101	Registered	0-127	LSB
52-63	Undefined	0-127	LSB		Parameter Number MSB		
64	Damper pedal	≤63=off ≥64=on		102-119	Undefined		
	on/off (Sustain)			120-127	Mode messages		

VI. MIDI Implementation

Function...		Transmitted	Recognized	Remarks
Basic Channel	Default changed	* 1-16 * 1-16	X X	memorised
Mode	default Messages Altered	Mode 3 X X	X X X	
Note Number	True Voice	* 0-127 * 0-127	X X	memorised
Velocity	NOTE ON NOTE OFF	1-127 64	X X	
After Touch	Key Channel	o o	X X	
Pitch Bender		o	X	10 bit resolution
Control Change		* 0-127	X	memorised
Program Change		* 0-127	X	Program number 1-128
System Exclusive		o	o	
System Common	Song Pos Song Sel Tune	X X X	X X X	
System Real time	Clock Commands	X X	X X	
AUX Messages	Local ON/OFF All Notes OFF Active Sense Reset	X X X X	X X X X	

Mode 1: OMNI ON, POLY
Mode 2: OMNI ON, MONO
o: Yes
Mode 3: OMNI OFF, POLY
Mode 4: OMNI OFF, MONO
X: No

CE

CE norm & FCC INFORMATION

1. Important notice: do not modify this unit!
This product, when installed as indicated in the instructions contained in this manual, is compatible with the CE norm & FCC requirements.

2. Important!
When connecting this product to accessories and/or another product, use only high quality shielded cables. Cables supplied with this product must be used. Follow all installation instructions. Failure to follow instructions could void your FCC authorisation to use this product in the USA.

Note: this product has been tested and found to comply with the requirements listed in FCC Regulations, Part 15 for Class B digital devices & in The European Standard EN 50081-1 on Electromagnetic Compatibility - Generic emission standard on residential, commercial and light industry. Compliance with these requirements provides a reasonnable level of assurance that the use of this product in a residential environment will not result in harmful interference with other electronic devices.

Other Eobody2 interfaces soon available

ethernet 32 in interface... a complete control system for performances, installations...

wireless 8 in interface

Development Team

Marc Sirguy, Eowave CEO (micro controller programming, PCB, software, specs and concept)
Emmanuelle Gallin, Eowave (specs and concept, industrial design, manual)

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We hope that this new versions will fit all your needs... even better than before...

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